MRI

MIDWEST RESEARCH INSTITUTE
Suite 350
401 Harrison Oaks Boulevard
Cary, North Carolina 27513-2412
Telephone (919) 677-0249
FAX (919) 677-0065

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From: David Randall
Karen Schmidtke

To: Lalit Banker
ESD/OCG (MD-13)
U. S. Environmental Protection Agency
Research Triangle Park, NC 27711

I. Introduction

The purpose of this memorandum is to describe model emission points and model plants that were developed to characterize affected sources under the MACT standard for the pesticide active ingredient (PAI) manufacturing source category. Model emission points (i.e., process vents, equipment leak components, storage tanks, wastewater systems, and bag dumps and product dryers) were developed for estimating the environmental and cost impacts of regulatory alternatives. Model plants (i.e., various combinations of the model emission points) were developed for estimating economic impacts.

There are an estimated 78 plants nationwide that would be affected sources under the MACT standard for the PAI manufacturing source category.[1] Information is available for 20 of these plants, leaving 58 to be modelled. The 20 facilities for which information is available are referred to in this memorandum as "surveyed" plants, and the other 58 plants are referred to as "modelled" plants.

To simplify the impacts analyses, models were developed to characterize each of the 20 surveyed plants. The same models were then used to characterize the 58 additional plants. The procedures used to develop the models and the characteristics of the models are described in the remainder of this memorandum. Model process vents, equipment leaks, storage tanks, wastewater systems, and bag dumps and product dryers are described in sections II through VI, respectively. Sections VII and VIII cover the model plants for existing and new sources, respectively. Section IX lists the references.

II. Model Process Vents

Most of the available process vent emissions data are for manifolded streams, not individual vent streams. Therefore, model process vents were developed on a process basis. In the remainder of this discussion, the terms "emissions" or "process emissions" refer to aggregated emissions from all of the vents associated with a process.

Each of the 58 modelled plants are estimated to have 2 PAI processes, for a nationwide total of 116 "projected" processes. As noted in the data summary memorandum, the 20 surveyed plants have a total of 93 processes, for an average of 4.7 per plant.[2] This is believed to be higher than the industry average because an effort was made to obtain information from some of the known large plants.[2] In addition, a 1986 survey by EPA's Office of Water found that more than half of the plants in the industry produced only one active ingredient. The 1986 survey also found an average of about 2 processes per plant (although it did not account for production of intermediates in separate processes, and it may not have covered all active ingredients that were produced at the plant).[3] The estimate of two processes per plant for this modelling analysis was selected to be consistent with those findings.

Table 1 shows the distribution of processes at the surveyed plants and the assumed distribution of projected processes. Batch and continuous processes with organic HAP emissions account for more than 85 percent of the surveyed processes. Many of these processes also emit HCl. Models were developed based on these processes because it is expected that they are also the most prevalent in the rest of the industry.

TABLE 1. DISTRIBUTION OF SURVEYED AND MODEL PROCESSES[a]

Type of process	Surveyed processes		Projected processes	
	Uncontrolled emissions ≥cutoff	Uncontrolled emissions <cutoff	Uncontrolled emissions ≥cutoff	Uncontrolled emissions <cutoff
Batch with organic HAP	46	17	67	23
Continuous with organic HAP	18	0	26	0
Batch with only inorganic HAP[b]	1	2	0	0
Continuous with only inorganic HAP[b]	1	0	0	0
Batch/continuous	8	0	0	0
Total	74	19	93	23

[a]The cutoff is 0.15 Mg/yr for organic HAP and 6.8 Mg/yr for HCl (72 surveyed processes exceed the organic HAP cutoff, and 2 additional surveyed processes exceed only the HCl cutoff).
[b]Inorganic HAP includes HCl, chlorine, hydrogen cyanide, and hydrazine.

To simplify the analysis, unique models to represent other types of processes and other types of HAP emissions were not developed. Also, such processes can be adequately represented by the existing models. For example, unique models for processes that are a combination of batch and continuous operations were not developed because these processes also have organic HAP emissions, and it is believed that the impact of regulations on such processes can be adequately estimated by representing some as batch processes and others as continuous processes. Unique models for processes that emit only inorganic HAP (typically HCl) were not developed because some of the models for processes that emit organic HAP also emit HCl. Thus, using model processes that emit both HCl and gaseous organic HAP to represent processes that emit only HCl is expected to provide a worst case estimate of emissions and cost impacts.

According to the data in Table 1, the surveyed plants have 74 processes with uncontrolled HAP emissions equal to or greater than cutoffs established in the MACT floor memorandum (i.e., 0.15 Mg/yr for organic HAP and 6.8 Mg/yr for HCl emissions) and

19 processes have lower emissions (i.e., 80 percent and 20 percent, respectively).[4] Based on the assumption that this distribution is applicable in the industry as a whole, 93 of the 116 projected processes were characterized with uncontrolled HAP emissions above the cutoffs, and 23 were characterized with lower uncontrolled HAP emissions. The number of processes with uncontrolled emissions above and below the cutoffs was determined because the MACT floor control level differed for the two groups.[4]

The distribution of batch and continuous projected processes was based on the distribution of surveyed processes. As shown in Table 1, the surveyed plants have 46 batch and 18 continuous processes with organic HAP emissions equal to or greater than the cutoffs (i.e., 72 percent batch and 28 percent continuous). Applying this same ratio to the 93 projected processes with uncontrolled emissions equal to or greater than the cutoffs resulted in 67 batch processes and 26 continuous processes. The same methodology was used to estimate the distribution of the 23 projected processes with uncontrolled emissions below the cutoffs.

Four model processes were developed to characterize the 93 projected processes with uncontrolled HAP emissions equal to or greater than the cutoffs. Table 2 shows the operating parameters and uncontrolled emissions for the four groups of processes at the surveyed plants that were used to develop these models. The resulting parameters for the model processes are shown in Table 3. No model processes were developed to characterize the 23 projected processes with uncontrolled emissions below the cutoffs because no regulatory alternatives were developed for these processes.

The primary parameters used to differentiate among the models were the type of HAP (chlorinated or unchlorinated) and the type of process (batch or continuous). The type of HAP was used because emissions streams with chlorine often require additional control equipment to remove, or prevent the formation of, HCl. The type of process was selected as a critical

TABLE 2. SUMMARY OF PROCESS VENT CHARACTERISTICS AT SURVEYED PLANTS

Plant no.	Process no.	B/C	Process operating hr/yr	Uncontrolled emissions, Mg/yr				
				Chlorinated organics	Unchlor- inated	HCl	Other	Total
15	57	B	3,960	0	0.276	0	0	0.276
11	36	B	7,776	0	0.399	0	0	0.399
21	70	B	127	0	0.447	0	0	0.447
15	58	B	5,220	0	0.679	0	0	0.679
3	12	B	4,176	0	0.782	0	0	0.782
21	71	B	148	0	0.820	0	0	0.820
21	72	B	169	0	0.857	0	0	0.857
21	73	B	189	0	0.969	0	0	0.969
14	46	B	288	0	1.00	0	0	1.00
22	81	B	300	0	1.38	0	0	1.38
8	22	B	2,208	0	1.41	(a)	0	1.41
15	54	B	5,784	0	1.59	0.157	0	1.74
14	43	B	792	0	1.74	0	0	1.74
14	44	B	696	0	1.76	0	0	1.76
14	47	B	576	0	2.28	0	0	2.28
14	45	B	840	0	3.19	0	0	3.19
22	77	B	1,184	0	4.54	0	0	4.54
22	76	B	1,776	0	4.54	0	0	4.54
21	69	B	570	0	5.81	0	0	5.81
6	16	B	4,404	0	16.5	0	0	16.5
22	78	B	1,036	0	23.8	0	0	23.8
12	38	B	1,170	0	24.3	0.00014	7.71	32.0
21	68	B	4,056	0	28.5	0	0	28.5
7	17	B	6,072	0	33.0	0	0	33.0
19	64	B	6,318	0	34.3	0	0	34.3
22	85	B	1,542	0	66.7	0	0	66.7
20	66	B	840	0	81.8	0	0	81.8
22	84	B	2,496	0	96.3	0.101	0	96.4
23	90	B	1,340	0.00771	0.198	0.410	0	0.616
23	89	B	2,320	0.0132	0.342	0.710	0	1.07
17	60	B	1,548	0.337	0	0	0	0.337
23	92	B	360	0.486	1.39	0.00064	0.00045	1.88
3	7	B	8,160	0.693	0	0	0	0.693
22	83	B	1,946	22.7	6.27	0	0	28.9
23	93	B	4,150	40.1	18.6	0.557	0	59.2
5	15	B	6,039	42.8	9.05	0	0	51.9
22	82	B	8,760	45.4	12.2	0	0	57.5
8	20	B	2,208	0.0454	15.2	6.80	0	22.1
3	11	B	8,160	0	0.403	9.00	0	9.41
12	37	B	1,368	0	4.59	11.0	0	15.6
21	67	B	8,400	0	129	12.0	0	141
12	40	B	1,568	32.8	15.4	26.7	0	74.9
23	94	B	4,370	26.5	38.5	33.1	0	98.1
22	79	B	432	8.30	0	54.4	0	62.8
22	75	B	4,500	53.1	0	349	0	402
9	24	B	5,568	0	0	356	0	356

TABLE 2. SUMMARY OF PROCESS VENT CHARACTERISTICS AT SURVEYED PLANTS (CONTINUED)

Plant no.	Process no.	B/C	Process operating hr/yr	Uncontrolled emissions, Mg/yr				
				Chlorinated organics	Unchlor-inated	HCl	Other	Total
5	14	C	7,464	0	0.916	0	0	0.916
22	80	C	456	0	1.81	0	0	1.81
17	61	C	1,920	0	8.19	0	0	8.19
17	62	C	2,424	0	15.3	0	0	15.3
17	63	C	8,064	0	200	0	0	200
1	2	C	336	0.0459	5.59	0.0262	0	5.66
1	4	C	720	0.0751	9.14	0.0428	0	9.26
1	3	C	720	0.158	19.3	0.0904	0	19.5
7	18	C	5,300	0.181	12.6	0	0	12.8
1	1	C	5,040	1.11	135	0.633	0	137
10	27	C	7,680	31.3	0	0	1.39	32.7
3	6	C	8,136	50.9	0	0	0	50.9
11	33	C	7,176	60.3	4.4	0.761	0	65.5
8	23	C	7,896	0	0	14.5	0	14.5
8	19	C	7,896	0.0431	202	13.2	0	215
23	91	C	7,488	4.02	0	117	0	121
12	39	C	7,000	199	0	67.2	0	266
9	25	C	3,384	18.2	0	174	0	192
22	74	C	5,184	347	0	2,360	0	2,707

(a) No data provided.

TABLE 3. MODEL PROCESS PARAMETERS

Parameters	Models 1	Models 2	Models 3	Models 4
Type of process	Batch	Batch	Continuous	Continuous
Type of organic HAP	Unchlorinated	Chlorinated	Unchlorinated	Chlorinated
Typical organic HAP	Toluene	Methylene chloride and toluene	Toluene	Methylene chloride and toluene
Operating hours, hr/yr	2,800	2,800	5,000	5,000
Gas flow rate, scfm -dilute -concentrated	 2,950 683	 2,080 21	 41,100 140	 32,900 131
Number of vents per process	6	6	6	6
Uncontrolled emissions, Mg/yr/process HCl chlorinated unchlorinated	 0 0 13.7	 66.1 20.9 19.1	 0 0 41.0	 295 78.9 22.9
Number of model processes	48	19	14	12

parameter because batch processes often operate fewer hours, produce less product, and are more difficult to control than continuous processes.

The average emissions data for 46 of the 47 batch processes and all 19 of the continuous processes at the surveyed plants were used to develop the emissions levels for the four model processes; the data for these processes are shown in Table 2. Data for the 8 surveyed batch/continuous processes were not included in Table 2 because this type of process was not modelled. Thirty-three of the 47 batch processes emitted unchlorinated organic HAP, HCl <6.8 Mg/yr, and chlorinated organic HAP <7.9 Mg/yr (i.e., the amount of methylene chloride that would be needed to generate 6.8 Mg/yr of HCl if all of the chlorine were converted to HCl in a combustion-based control device). The average uncontrolled organic HAP emissions for these 33 processes was 13.7 Mg/yr. This level was used for model process 1. Thirteen of the 47 batch processes emitted chlorinated organic HAP >7.9 Mg/yr, HCl >6.8 Mg/yr, or both; 10 of these processes also emitted unchlorinated organic HAP. The average chlorinated organic, unchlorinated organic, and HCl emissions for these 13 processes were 20.9, 19.1, and 66.1 Mg/yr, respectively. These levels were used for model process 2. One of the 47 batch processes was not used to establish model parameters because of its characteristics; emissions from this processes consisted primarily of very high amounts of HCl and phosgene.

The average emissions data for the 19 continuous processes at the surveyed plants were used to develop the emissions levels for model processes 3 and 4. Ten of the 19 continuous processes emitted unchlorinated organic HAP, HCl <6.8 Mg/yr, and chlorinated organic HAP <7.9 Mg/yr. The average organic HAP emissions for these 10 processes was 41.0 Mg/yr. This level was used for model process 3. Nine of the 19 continuous processes emitted chlorinated organic HAP >7.9 Mg/yr, HCl >6.8 Mg/yr, or both; 2 of these processes also emitted unchlorinated organic HAP. The average chlorinated organic, unchlorinated organic, and HCl emissions for these 9 processes were 78.9, 22.9, and 295 Mg/yr, respectively. These levels were used for model process 4.

The distribution of the processes in Table 2 was also used to determine the distribution of the four model processes among the 93 projected processes with uncontrolled HAP emissions equal to or greater than the cutoffs. Of the 46 batch processes in Table 2, 33 were used to develop the emissions level for model process 1, and 13 were used to develop the emissions level for model process 2. This same ratio was applied to the 67 projected batch processes from Table 1, resulting in 48 processes represented by model process 1 and 19 processes represented by model process 2. Of the 19 continuous processes in Table 2, 10 were used to develop the emissions level for model process 3, and 9 were used to develop the emissions level for model process 4. This same ratio was applied to the 26 projected continuous processes in Table 1, resulting in 14 processes represented by model process 3 and 12 processes represented by model process 4.

Operating hours were available for all 46 batch processes and 19 continuous processes in Table 2. Operating hours were also available for another 13 batch processes with emissions <0.15 Mg/yr (330 lb/yr).[2] The 59 batch processes operated for an average of about 2,800 hr/yr, and the 19 continuous processes operated for an average of about 5,000 hr/yr. These values were used for the model processes.

The typical unchlorinated HAP for the model processes was assumed to be toluene because it was emitted from the most surveyed processes and in greater quantities than any other organic HAP.[2] A wide variety of chlorinated organics were emitted from the surveyed processes. Overall, the chlorinated HAP's had an average of about two chlorine atoms per molecule. Ethylene dichloride, methylene chloride, and phosgene were the only organic HAP's with two chlorine atoms per molecule emitted from processes in the PAC industry.[2] Methylene chloride was emitted in the smallest quantity. However, it was selected for the model processes for several reasons. First, it was used at the most plants (one more than the others). Relative to ethylene dichloride, methylene chloride has a higher vapor pressure, lower heat of combustion, and nearly the same heat of condensation. These characteristics would make methylene chloride more difficult to control and more costly to control. Thus, using methylene chloride in the model would result in a worst-case impacts analysis. Phosgene was not selected because it is not combustible and decomposes in water; thus, it is not representative of most chlorinated organic compounds.

Two gas flow rates, one for dilute streams and one for concentrated streams, were estimated for each of the four model processes. These flow rates are equivalent to the weighted average of the flow from a single vent stream created by manifolding all of the individual vent streams from a process. The data and procedure used to estimate the model flow rates are presented in a separate memorandum.[5]

III. Equipment Leak Models

Two equipment leak models were developed from data for 30 of the 93 processes at the surveyed plants. The equipment components used in the models are flanges, pumps, valves in gas service (gas valves), and valves in liquid service (liquid valves). Other types of components were not included in the modeling because they were not present in significant quantities.

The component counts for all 30 surveyed processes are shown in Table 4. The counts for flanges and pumps are as reported by the plants. Counts for gas and liquid valves were also available for 17 of the processes, but only the total number of valves was available for the other 13 processes. Liquid valves accounted for an average of about 80 percent of the valves in the 17 processes. This distribution was used to estimate the number of gas and liquid valves in the other 13 processes.

Parameters for both of the equipment leak models are shown in Table 5. One of the models characterizes batch processes, and one characterizes continuous processes. The equipment counts for models 1 and 2 were developed by averaging the equipment counts for the batch and continuous processes, respectively, in Table 4. As noted in Section II, model batch processes were estimated to operate 2,800 hr/yr, and continuous processes were estimated to operate 5,000 hr/yr.

Uncontrolled emissions for the models were calculated using SOCMI average emission factors for connectors, valves in gas service and light liquid service, and pumps in light liquid service.[6] It was assumed that components were in service 100 percent of the process operating hours and that they were in contact with process fluid that is 100 percent HAP.

According to section 163.161 of 40 CFR part 63 subpart H, light liquid service for equipment components means a piece of equipment in organic HAP service meets the following conditions:

TABLE 4. EQUIPMENT COMPONENT COUNTS FOR PROCESSES AT SURVEYED PLANTS

Process Number[a]	Batch or continuous	Number of components			
		Flanges	Pumps	Gas valves	Liquid valves
1	B	0	0	0	32
2	B	44	0	1	7
3	B	44	0	1	7
4	B	100	1	6	20
5	B	192	0	50	323
6	B	252	3	61	75
7	B	372	6	32	129
8	B	506	7	41	165
9	B	593	11	4	218
10	B	810	2	11	231
11	B	812	4	76	154
12	B	914	14	72	290
13	B	1,098	5	43	278
14	B	1,140	1	126	294
15	B	1,453	20	89	354
16	B	2,839	44	190	762
17	B	2,979	33	191	765
18	B	3,528	53	260	1,040
19	B	3,528	53	260	1,040
20	C	0	13	108	430
21	C	0	128	947	3,788
22	C	980	7	19	392
23	C	1,284	4	35	508
24	C	1,500	33	278	954
25	C	1,500	33	278	954
26	C	1,500	33	278	954
27	C	1,500	33	278	954
28	C	2,591	28	260	1,330
29	C	2,604	22	251	1,004
30	C	2,740	27	222	886

TABLE 5. PARAMETERS FOR EQUIPMENT LEAK MODELS

Parameters	Models	
	1	2
Type of model process	Batch	Continuous
Operating hours, hr/yr	2,800	5,000
Equipment counts		
Flanges	1,100	1,500
Pumps[a]	14	33
Gas valves	65	240
Liquid valves[a]	340	1,100
Uncontrolled emissions, Mg/yr/process	11.3	46.3
Number of models		
At modelled plants	90	26
At surveyed plants	48	11
Total	138	37

[a]Light liquid service.

(1) the vapor pressure of one or more of the organic compounds is greater than 0.3 kilopascals (kPa) at 20°C, (2) the total concentration of the pure organic compounds having a vapor pressure greater than 0.3 kPa at 20°C is equal to or greater than 20 percent by weight of the total process stream, and (3) the fluid is a liquid at operating conditions.

Seventy-eight of the 84 processes with organic HAP emissions use at least one HAP that would satisfy the vapor pressure condition for light liquid service.[2] The concentration of HAP in the process fluid is unknown; however, as noted above, emissions for the equipment leak models were calculated assuming 100 percent HAP. Because equipment count data were provided by plants that were implementing leak detection and repair (LDAR) programs, it is likely that they reported only those components that are in contact with a liquid process fluid at operating conditions. Thus, all of the modelled liquid valves and pumps were assumed to be in light liquid service.

The equipment count models were used to characterize components in both the 116 model processes and 63 processes from the surveyed plants for which equipment counts were not available (i.e., 93-30=63). Eight of the 63 processes were identified as combinations of batch and continuous operations; five of these processes were characterized with the batch model, and three were characterized with the continuous model. Four of the 63 processes use only inorganic or granular HAP and, thus, would not have any organic HAP emissions. As a result, Table 5 shows 175 processes represented by the models (i.e., 116+59=175).

IV. Model Storage Tanks

Model tanks were developed by sorting the data from organic (plus 2 inorganic) HAP storage tanks at major sources. The characteristics of 82 storage tanks from 16 major sources were used in the development of model tanks.[2] It was assumed that the number of storage tanks and their characteristics at the 16 surveyed plants are representative of tanks at other plants in the PAI production industry. Table 6 contains data for the 82 storage tanks that were used to define the model tank parameters. The primary parameters used to develop the model tanks include tank capacity, the uncontrolled emissions, and the control efficiency. The models are based on three capacity ranges as follows:

1. Models 1 - <20,000 gal;
2. Models 2 - ≥20,000 and <40,000 gal; and
3. Models 3 - ≥40,000 gal.

The uncontrolled emission level and the control efficiency were used to further define the models. Based on uncontrolled emissions and the control efficiency, three models for each tank capacity range were developed:

1. A - all tanks with uncontrolled emissions ≥110 kg/yr (≥240 lb/yr) and control efficiency ≥95 percent;
2. B - all tanks with uncontrolled emissions ≥110 kg/yr (≥240 lb/yr) and control efficiency <95 percent; and
3. C - all tanks with uncontrolled emissions <110 kg/yr (<240 lb/yr).

TABLE 6. STORAGE VESSELS AT SURVEYED FACILITIES

Tank No.	HAP	Tank size, gal	Annual Throughput, gal	Vapor Pressure, psia	Uncontrolled emissions, ~~Mg~~ kg	Control efficiency, %
TANKS <20,000 gal (41 TANKS)						
1	TOLUENE	15,000	14,700,000	0.5494	1,290	98
2	MIX-CARBON TETRACHLORIDE/TETRACHLOROETHYLENE	15,750	324,900	1.8742	1,050	98
3	MIX-CARBON TETRACHLORIDE/TETRACHLOROETHYLENE	15,750	324,900	1.8742	1,050	98
4	TOLUENE	15,000	10,800,000	0.5494	1,000	98
5	TOLUENE	15,000	3,640,000	0.5494	483	98
6	TOLUENE	15,000	1,810,000	0.5494	350	98
7	MIX-CARBON TETRACHLORIDE/TETRACHLOROETHYLENE/ HEXACHLOROETHANE/HEXACHLOROBENZENE	8,400	537,700	0.5381	283	98
8	TOLUENE	10,300	213,000	0.5494	124	98
9	TETRACHLOROETHYLENE	5,200	348,700	0.3499	121	98
10	METHYLENE CHLORIDE	6,540	52,980	7.9181	554	4
11	METHANOL	15,000	490,000	2.4155	394	0
12	METHYL ETHYL KETONE	17,500	160,000	1.7443	269	0
13	METHANOL	13,500	755,800	2.2488	260	42
14	TOLUENE	12,690	2,120,260	0.5254	231	13.2
15	METHANOL	15,000	213,950	2.4155	212	0
16	DIMETHYL HYDRAZINE	14,000	12,540	3.033	190	0
17	DIMETHYL HYDRAZINE	12,000	13,330	3.033	164	0
18	TOLUENE	13,500	322,530	0.5302	118	41
19	METHANOL	10,500	33,000	2.4155	76.8	98
20	MIX-TOLUENE/METHYLENE CHLORIDE	10,300	111,000	0.456	65.6	98
21	TOLUENE	10,300	75,000	0.5494	63.9	98
22	ACETONITRILE	12,387	7,120	1.7824	62.2	0
23	MALEIC ANHYDRIDE	14,500	350,000	0.1812	55.5	99.5
24	METHANOL	10,000	81,000	2.4155	52.9	90
25	TOLUENE	15,000	19,914	0.5494	50.0	0
26	METHYL ISOBUTYL KETONE	7,900	175,000	0.373	45.6	89
27	TOLUENE	6,000	60,000	0.5494	45.1	95

TABLE 6. STORAGE VESSELS AT SURVEYED FACILITIES (continued)

Tank No.	HAP	Tank size, gal	Annual Throughput, gal	Vapor Pressure, psia	Uncontrolled emissions, ~~Mg~~ kg	Control efficiency, %
28	MIX-HEXANE/TRICHLOROBENZENE	7,500	7,800	0.7432	32.8	98
29	TOLUENE	10,000	3,670	0.4329	34.4	90
30	XYLENE	12,847	146,160	0.2267	32.5	0
31	METHANOL	7,500	38,000	2.4155	31.8	90
32	XYLENE	6,423	146,160	0.2267	25.6	0
33	XYLENE	5,313	146,160	0.2267	25.0	0
34	MALEIC ANHYDRIDE	16,000	177,681	0.0186	12.4	0
35	FORMALDEHYDE	7,000	11,000	0.058	0.38	98
36	MIX-BUTYL CELLOSOLVE/TRIETHYLAMINE	14,000	119,000	0.0052	0.54	0
37	ETHYLENE GLYCOL	7,000	224,000	0.0006	0.08	0
38	ETHYLENE GLYCOL	7,000	77,000	0.0006	0.04	0
39	ETHYLENE GLYCOL	7,000	77,000	0.0006	0.04	0
40	ETHYLENE GLYCOL	17,760	600	0.0002	0.01	0
41	CHLOROACETIC ACID	2,500	9,800	0.0002	0	0
Tanks > =20,000 and < 40,000 gal (21 TANKS)						
42	ETHYLENE DICHLORIDE	27,000	3,140,000	1.4824	1,360	98
43	MIX-CARBON TETRACHLORIDE/TETRACHLOROETHYLENE/ HEXACHLOROETHANE/HEXACHLOROBENZENE	33,000	179,200	1.4285	631 575	98
44	MIX-METHANOL/TOLUENE	30,000	2,250,000	1.195	242	98
45	XYLENE	32,000	747,310	0.2267	186	98
46	METHANOL	30,000	91,823	2.4155	118	98
47	XYLENE	32,000	308,147	0.2267	116	98
48	TOLUENE	32,000	79,000	0.5494	112	98
49	TOLUENE	31,600	68,478	0.5494	752	98
50	TRICHLOROETHYLENE	20,000	369,000	1.3353	752	0
51	HEXANE	20,000	33,800	2.9292	348	0
52	XYLENE	27,000	40,300	0.2267	49.7	0
53	TOLUENE	30,000	455,000	0.1284	43.8	98

TABLE 6. STORAGE VESSELS AT SURVEYED FACILITIES (continued)

Tank No.	HAP	Tank size, gal	Annual Throughput, gal	Vapor Pressure, psia	Uncontrolled emissions, ~~Mg~~ kg	Control efficiency, %
54	METHANOL	35,000	175,000	0.4855	32.2	0
55	HYDRAZINE	30,000	464,997	0.1562	30.0	0
56	HYDRAZINE	25,600	119,742	0.1562	12.7	0
57	MIX-FORMALDEHYDE/METHANOL	30,600	815,000	0.0715	7.05	98
58	TOLUENE	30,000	1,375,248	0.0042	4.08	0
59	TRICHLOROBENZENE	30,000	31,200	0.0082	3.40	0
60	BUTYL CELLOSOLVE	22,000	262,940	0.0139	1.72	0
61	ANILINE	20,000	20,540	0.013	0.33	0
62	ANILINE	20,000	20,540	0.013	0.33	0
Tanks > =40,000 gal (20 TANKS)						
63	TOLUENE	500,000	56,000,000	0.5494	11,500	95
64	TOLUENE	500,000	56,000,000	0.5494	11,500	95
65	MIX-TOLUENE/CYANURIC CHLORIDE	500,000	64,000,000	0.3469	5,020	95
66	MIX-TOLUENE/CYANURIC CHLORIDE	500,000	64,000,000	0.3469	5,020	95
67	ETHYLENE DICHLORIDE	144,000	2,890,000	1.4824	3,220	98
68	GLYCOL ETHER	66,000	176,440	1.5235	669	98
69	GLYCOL ETHER	66,000	176,440	1.5235	669	98
70	GLYCOL ETHER	66,000	176,440	1.5235	669	98
71	METHANOL	102,000	288,954	2.4155	524	98
72	XYLENE	47,000	1,226,040	0.2267	394	98
73	XYLENE	47,000	620,800	0.2267	223	98
74	TOLUENE	40,000	31,000	0.5494	127	98
75	METHANOL	75,000	816,334	2.4155	1,360	0
76	XYLENE	1,567,000	5,342,000	0.2233	1,090	25
77	METHANOL	100,000	500,000	2.4155	692	0
78	MIX-FORMALDEHYDE/METHANOL	50,000	3,069,544	0.0433	372	0
79	MIX-TOLUENE/CYANOHYDRIN	84,000	68,000	0.2686	108	98
80	TRICHLOROBENZENE	220,000	4,840,000	0.0082	98.2	0
81	TRICHLOROBENZENE	500,000	1,000,000	0.0082	67.3	0
82	MIX-ETHYL BENZENE/XYLENE	40,000	56,000	0.0565	16.6	98

A total of nine model tanks were developed to represent storage tanks in the PAI manufacturing industry; Table 7 presents the parameters for each of the models. Data in Table 6 were used to determine the number of tanks at surveyed plants to be characterized by each model. For example, 15 of the tanks in Table 6 have uncontrolled emissions ≥110 kg/yr (≥240 lb/yr) and control efficiencies less than 95 percent. Nine of these 15 tanks have capacities <20,000 gal, 2 have capacities ≥20,000 to <40,000, and 4 have capacities ≥40,000 gal. Therefore, these tanks are characterized by models 1B, 2B, and 3B, respectively. Table 7 shows the number of tanks at the surveyed plants represented by each of the 9 model tanks.

The number of storage tanks at the 58 modelled plants was estimated by extrapolating data from the 20 surveyed plants. The 20 surveyed plants have 82 tanks that store organic liquids. Assuming the average number of tanks per plant industry-wide is the same as at the surveyed plants results in an estimated total of 238 tanks at the 58 modelled plants (i.e., 82 x 58/20 = 238). This same ratio was used to estimate the number of tanks at the modelled plants represented by each of the model tanks. For example, 26 of the 238 tanks are represented by model 1B (i.e., 9 tanks at the surveyed plants multiplied by 58/20 equals 26). Table 7 shows the number of tanks at the modelled plants represented by each of the 9 model tanks.

V. <u>Wastewater Systems</u>

As noted in the data summary memorandum, the 20 surveyed plants reported a total of 72 POD wastewater streams that were generated from 45 of the 93 processes (48 percent).[2] Characteristics of aggregated wastewater streams from each of the 45 processes are presented in Table 8. These characteristics include: (1) the organic HAP loads and concentrations, (2) the wastewater flow rates, and (3) the total uncontrolled and controlled HAP emissions.

If 48 percent of all processes in the industry have wastewater streams, then an estimated 56 of the 116 model processes generate wastewater (45/94 x 116 = 56). Two approaches

TABLE 7. CHARACTERISTICS OF MODEL STORAGE TANKS

Parameters	Models								
	1-A	1-B	1-C	2-A	2-B	2-C	3-A	3-B	3-C
Tank capacity, gal	12,820	13,300	9,771	30,950	20,000	27,290	214,800	448,000	211,000
Avg throughput, gal/yr	3,633,000	460,200	91,130	858,000	201,400	343,700	20,470,000	2,432,000	1,491,000
Baseline control, percent	95%	11%	45%	95%	0%	18%	95%	6%	50%
Uncontrolled emissions per tank, kg/yr	640	226	31.0	418	550	16.8	3,300	876	72.5
No. of tanks per capacity range nationwide:									
at surveyed plants	9	9	23	8	2	11	12	4	4
at modelled plants	26	26	67	23	6	32	34	12	12

TABLE 8. CHARACTERISTICS OF MODEL WASTEWATER STREAMS

Wastewater stream model No.	HAP load, Mg/yr	Wastewater flowrate, gal/yr	HAP conc., ppmw	Process operation, hr/yr	Uncontrolled emissions, Mg/yr	Controlled emissions, Mg/yr	Nationwide wastewater streams		
							Surveyed plants	Model plants	Total
12	0.0050	36,981,000	0.0357	7,296	0.00319	0.00319	1	1	2
39	0.0318	222,100	38	1,036	0.0254	0.0254	1	1	2
36 (a)	0.041	220	49,111	2,200	0.0147	0.0147	1	1	2
28	0.051	1,824	7,371	960	0.0406	0.0406	1	1	2
6	0.173	411,000	111	7,809	0.0294	0.0294	1	1	2
11	0.181	2,630,000	18	7,680	0.169	0.00846	1	1	2
30	0.192	1,028	49,514	96	0.154	0.154	1	1	2
4	0.231	7,500,000	8	720	0.185	0.185	1	1	2
29	0.349	5,625	16,433	840	0.279	0.279	1	1	2
31	0.385	2,056	49,514	192	0.308	0.308	1	1	2
3	0.386	12,500,000	8	720	0.308	0.308	1	1	2
45	0.395	933,100	112	1,542	0.316	0.316	1	1	2
33	0.427	4,026,000	28	1,548	0.330	0.330	1	1	2
24	0.499	132,000	1,000	1,568	0.319	0.319	1	1	2
41	0.627	705,600	235	300	0.502	0.502	1	1	2
40	0.658	777,600	224	456	0.527	0.527	1	1	2
22	0.796	403,600	522	1,368	0.637	0.637	1	1	2
9	0.907	13,500,000	18	5,300	0.835	0.835	1	2	3
2	0.925	30,000,000	8	336	0.740	0.740	1	2	3
7	1.23	11,600	28,046	904	0.209	0.209	1	2	3
23	1.81	47,000	10,217	1,170	0.308	0.308	1	2	3
5	2.06	27,600,000	20	7,809	1.61	1.61	1	2	3
25	3.18	7,000,000	120		0.540	0.0540	1	2	3
1	6.17	200,000,000	8	5,040	4.94	4.94	1	2	3
8	6.78	73,420,000	24	6,039	2.17	2.17	1	2	3

TABLE 8. CHARACTERISTICS OF MODEL WASTEWATER STREAMS (CONTINUED)

Wastewater stream model No.	HAP load, Mg/yr	Wastewater flowrate, gal/yr	HAP conc., ppmw	Process operation, hr/yr	Uncontrolled emissions, Mg/yr	Controlled emissions, Mg/yr	Nationwide wastewater streams		
							Surveyed plants	Model plants	Total
20	8.94	1,819,000	1,301	3,588	3.46	0.0003	1	2	3
32	10.7	1,860,000	1,524	5,784	8.57	8.57	1	2	3
27	13.6	120,000	30,012	792	10.9	10.9	1	2	3
19	20.5	4,173,000	1,301	1,600	7.95	0.0008	1	1	2
13	22.1	978,900	5,974	1,272	12.4	0.0012	1	1	2
21	23.2	4,708,000	1,301	7,776	8.97	0.0009	1	1	2
44	34.1	695,700	12,955	2,496	8.70	8.70	1	1	2
35	34.1	22,520,000	400	6,318	11.6	11.6	1	1	2
43	35.9	885,600	10,737	1,946	6.98	6.98	1	1	2
26	51.3	4,000,000	3,391	8,760	24.6	24.6	1	1	2
15	66.3	2,937,000	5,973	3,072	37.3	0.0037	1	1	2
34	81.4	24,920,000	865	8,064	29.1	29.1	1	1	2
14	81.6	3,614,000	5,974	3,792	46.0	0.0046	1	1	2
38	91.2	5,930,000	4,072	4,056	17.7	17.7	1	1	2
42	143	3,514,000	10,774	8,760	26.1	26.1	1	1	2
10 (a)	223	130,000,000	453	7,896	42.5	42.5	1	1	2
18	282	3,700,000	20,172	7,176	181	0.0181	1	1	2
17	480	6,300,000	20,172	7,176	308	0.0308	1	1	2
37	491	47,810,000	2,719	8,400	94.7	94.6	1	1	2
16	1,143	5,600,000	54,039	7,104	327	0.0327	1	1	2

(a) At the surveyed plants, the treatment process for this stream is deepwell injection; therefore, controlled emissions are 0 Mg/yr. Emissions shown in this table are for the process at a projected plant.

were used to develop models to characterize the aggregated wastewater streams from each of the 56 processes. The first approach used all of the 72 streams at the surveyed plants as models; these model streams will be used to estimate baseline emissions, environmental impacts, and cost impacts. The second approach developed three model streams based on average characteristics of streams at the surveyed plants that meet the applicability criteria for control under the HON (i.e., assuming the same provisions are part of this regulation); these model streams will be used as part of the model plants that will be used for estimating economic impacts. Both approaches are discussed below.

A. Approach 1

Under approach 1, all of the 72 streams from the 45 processes at the surveyed plants were used as model streams. Because there were 56 processes to be characterized, the survey data needed to be extrapolated by a factor of 1.24 (56/45=1.24). This extrapolation was accomplished in two steps. First, each of the 45 processes was assumed to represent one of the model processes. Second, the HAP loads for the 45 processes were ranked, and each of the 11 processes in the middle of the rankings (0.24x45=11) was used to represent a second model process. This distribution allows for the use of whole streams rather than fractions, and it focuses the analysis on median streams rather than extremes. The rankings are presented in Table 8, and the characteristics of the individual streams for each process are presented in Table 9. In Table 9, wastewater flow rates in L/min were calculated assuming the wastewater is discharged continuously during the entire process operating time. The average fraction emitted (Fe) and fraction removed (Fr) values are weighted averages based on the fractional contribution of each HAP to the total load in the stream.

Approach 1 was developed for two reasons. First, the greater variety in streams may help in the process of deciding what applicability criteria should be established for the regulatory alternative above the MACT floor. For example, the

TABLE 9. CHARACTERISTICS OF INDIVIDUAL WASTEWATER STREAMS

Plant	WW stream (a)	Process operation, hr/yr	WW flow rate, gal/yr	WW flow rate, l/min	HAP load, Mg/yr	HAP conc., ppmw	Uncontrolled emissions, Mg/yr	Average Fe	Average Fr
1	1	5,040	200,000,000	2,503	6.17	8	4.94	0.8	0.99
1	2	336	30,000,000	5,632	0.925	8	0.740	0.8	0.99
1	3	720	12,500,000	1,095	0.386	8	0.308	0.8	0.99
1	4	720	7,500,000	657	0.231	8	0.185	0.8	0.99
3	5	7,809	27,600,000	223	2.06	20	1.61	0.78	0.99
3	6	1,425	411,000	18	0.173	111	0.029	0.17	0.31
3	7	904	11,600	1	1.23	28,046	0.209	0.17	0.31
5	8	6,039	73,417,207	767	6.78	24	2.17	0.32	0.9
7	9	5,304	13,500,000	161	0.907	18	0.835	0.92	0.99
8	10	7,896	130,000,000	1,039	223	453	42.47	0.191	0.338
10	11	7,296	2,630,000	23	0.181	18	0.170	0.932	0.990
10	12	7,296	36,981,000	320	0.0050	0	0.003	0.64	0.99
11	13a	1,272	908,700	45	20.5	5,977	11.6	0.563	0.990
11	13b	1,272	70,200	3	1.57	5,936	0.887	0.563	0.990
11	14a	3,792	3,355,200	56	75.8	5,977	42.7	0.563	0.990
11	14b	3,792	259,200	4	5.81	5,936	3.28	0.563	0.990
11	15a	3,072	2,726,100	56	61.6	5,977	34.7	0.563	0.990
11	15b	3,072	210,600	4	4.72	5,936	2.66	0.563	0.990
11	16a	7,104	4,400,000	39	902	54,227	257	0.286	0.441
11	16b	7,104	1,200,000	11	242	53,352	69.1	0.286	0.441
11	17a	7,176	1,260,000	11	1.56	328	1.25	0.8	0.99
11	17b	7,176	5,040,000	44	479	25,133	306	0.64	0.99
11	18a	7,176	740,000	7	0.916	328	0.733	0.8	0.99
11	18b	7,176	2,960,000	26	281	25,133	180	0.64	0.99
11	19	1,600	4,173,000	165	20.5	1,301	7.95	0.387	0.544
11	20	3,588	1,819,000	32	8.94	1,301	3.46	0.387	0.544
11	21	7,776	4,708,000	38	23.2	1,301	8.97	0.387	0.544
12	22a	1,368	3,600	0	0.0069	510	0.0056	0.8	0.99
12	22b	1,368	159,000	7	0.327	544	0.261	0.8	0.99
12	22c	1,368	33,000	2	0.064	509	0.051	0.8	0.99
12	22d	1,368	208,000	10	0.399	508	0.319	0.8	0.99
12	23	1,170	47,000	3	1.81	10,217	0.308	0.17	0.31
12	24	720	132,000	12	0.499	1,000	0.319	0.64	0.99
13	25		7,000,000		3.18	120	0.540	0.17	0.31
13	26	8,760	4,000,000	29	51.3	3,391	24.6	0.48	0.95
14	27	792	120,000	10	13.6	30,012	10.9	0.8	0.99
15	28	960	1,824	0	0.051	7,371	0.041	0.8	0.99
15	29	840	5,625	0	0.349	16,433	0.279	0.8	0.99
15	30	96	1,028	1	0.192	49,514	0.154	0.8	0.99
15	31	192	2,056	1	0.385	49,514	0.308	0.8	0.99

TABLE 9. CHARACTERISTICS OF INDIVIDUAL WASTEWATER STREAMS (CONTINUED)

Plant	WW stream (a)	Process operation, hr/yr	WW flow rate, gal/yr	WW flow rate, l/min	HAP load, Mg/yr	HAP conc., ppmw	Uncontrolled emissions, Mg/yr	Average Fe	Average Fr
15	32	5,784	1,857,146	20	10.7	1,527	8.57	0.8	0.99
17	33	7,896	4,026,000	32	0.427	28	0.330	0.774	0.990
17	34	8,064	24,917,933	195	81.4	865	29.1	0.358	0.620
19	35a	6,318	675,500	7	1.02	401	0.348	0.34	0.99
19	35b	6,318	1,680,000	17	2.54	401	0.864	0.34	0.99
19	35c	6,318	10,080,000	101	15.3	400	5.19	0.34	0.99
19	35d	6,318	10,080,000	101	15.3	400	5.19	0.34	0.99
20	36	840	220	0	0.041	49,111	0.015	0.36	0.62
21	37a	8,400	1,512,000	11	0.774	136	0.132	0.17	0.31
21	37b	8,400	4,536,000	34	5.15	300	0.875	0.17	0.31
21	37c	8,400	85,909	1	0.00029	1	0.00005	0.17	0.31
21	37d	8,400	1,008,000	8	0	0	0	0.17	0.31
21	37e	8,400	2,520,000	19	145	15,197	24.6	0.17	0.31
21	37f	8,400	1,260,000	9	81.6	17,145	13.9	0.170	0.310
21	37g	8,400	14,407,848	108	109	1,993	25.5	0.235	0.381
21	37h	8,400	800	0	0.0264	8,726	0.0045	0.17	0.31
21	37i	8,400	10,500	0	0.242	6,111	0.044	0.183	0.324
21	37j	8,400	3,500	0	0.144	10,860	0.061	0.425	0.585
21	37k	8,400	22,165,920	166	149	1,783	29.3	0.197	0.339
21	37l	8,400	140,000	1	0.405	765	0.069	0.17	0.31
21	37m	8,400	157,500	1	0.215	362	0.037	0.17	0.31
21	38a	4,079	5,250,000	81	90.9	4,581	17.5	0.193	0.335
21	38b	4,079	30,100	0	0.222	1,954	0.072	0.324	0.477
21	38c	4,079	145,950	2	0.136	247	0.109	0.8	0.99
21	38d	4,079	504,000	8	0.0059	3	0.0047	0.8	0.99
22	39	1,036	222,071	14	0.032	38	0.025	0.8	0.99
22	40	456	777,600	108	0.658	224	0.527	0.8	0.99
22	41	300	705,600	148	0.627	235	0.502	0.8	0.99
22	42	8,760	3,513,600	25	143	10,776	26.1	0.182	0.323
22	43	1,946	885,600	29	35.9	10,737	6.98	0.194	0.336
22	44	2,496	695,665	18	34.1	12,956	8.70	0.255	0.402
22	45	1,542	933,120	38	0.395	112	0.316	0.8	0.99

(a) The letter designations after the wastewater stream number indicate multiple streams are discharged from a given process.

impact of differences in load, Fe, and flow on the cost effectiveness may be easier to understand when using numerous individual models rather than only a few average models. Second, by using all of the streams as models, the baseline emissions will not change with changes in the regulatory alternative applicability criteria. Conversely, changes in the applicability criteria would change the group of streams used as the basis for each model, and this could result in changes to the baseline emissions.

B. Approach 2

Under approach 2, three model streams were developed to characterize streams that meet the applicability criteria for control under the HON. The applicability criteria are a HAP concentration greater than or equal to 10,000 ppmv at any flow rate or a HAP concentration greater than or equal to 1,000 ppmv at a flow rate greater than or equal to 10 liters per minute. Characteristics for these three model streams are shown in Table 10.

Examination of the flow rates and HAP loads for the wastewater streams in Table 9 shows that a total of 27 of the 72 wastewater streams exceed the applicability cutoffs for the HON. Based on the estimated population of these 22 processes at the surveyed and modelled plants (Table 8), wastewater streams from 40 processes would need to be controlled (note that streams from processes 13 through 21 at the surveyed plants are already controlled). In situations where a facility generates multiple wastewater streams, an aggregated stream was developed for use in costing analyses. For example, streams 29, 30, 31, and 32 were aggregated for surveyed plant 15; streams 37 and 38 were aggregated for surveyed plant 21; and streams 42, 43, and 44 were aggregated for surveyed plant 22. These streams were not aggregated for a model plant because no information is available to suggest that multiple processes similar to those at any of the surveyed plants would be located at any other individual plant. However, streams 13a, 14a, and 15a were combined for a single model plant because these streams are generated by flexible

TABLE 10. CHARACTERISTICS OF MODEL WASTEWATER STREAMS

Parameters	Models		
	LFr	HFr	HW
Flow rate, gal/yr	9,000,000	2,500,000	20,500
HAP loading, Mg/yr	278	91.4	1.1
HAP concentration, ppmw	8,200	9,700	14,400
Process operating time, hr/yr	6,100	4,000	820
Uncontrolled emissions, Mg/yr	66	57	0.255
Number of POD's	10	11	9

processing equipment that is used to produce three similar products at a surveyed plant; it was assumed that similar flexible operating equipment would exist a a model plant. Similarly, streams from processes 19, 20, and 21 were aggregated.

Aggregating the streams from multiple processes at a plant resulted in 30 wastewater streams to control. The characteristics of these 30 streams are shown in Table 11. These 30 streams were classified into three groups. The first group consists of streams with HAP's that only have high Fr values. The second group contains streams with at least one HAP that has a low Fr value. The third group contains small-volume streams for which disposal as a hazardous waste was determined to be less costly than on-site treatment in a steam stripper.[7] These three groups are represented by models LFr, HFr, and HW, respectively. As shown in Table 10, 10 streams were represented by model LFr, 11 streams were represented by model HFr, and 9 streams were represented by model HW.

The characteristics of the models in Table 10 were based on the characteristics of the streams in the three groups in Table 11. The HAP loads, process operating hours, and uncontrolled emissions for all three models, and the wastewater flow rate for

TABLE 11. CHARACTERISTICS OF AGGREGATED WASTEWATER STREAMS

Model stream	Process operating time, hr/yr	Flow, gal/yr	Load, Mg/yr	Average Fe	Uncontrolled emissions, Mg/yr	Average Fr	Nationwide number of streams
13a, 14a, and 15a	8,136	6,990,000	158	0.56	89.0	0.99	1
17b	7,176	5,040,000	479	0.64	306	0.99	1
18b	7,176	2,960,000	281	0.64	180	0.99	1
26	8,760	4,000,000	51.3	0.48	24.6	0.95	3
27	792	120,000	13.6	0.8	10.9	0.99	2
32	5,784	1,857,000	10.7	0.8	8.57	0.99	1
29, 30, 31, and 32	5,784	1,866,000	11.6	0.8	9.31	0.99	2
16a, b	7,104	5,600,000	1,144	0.286	326	0.441	1
20	3,588	1,819,000	8.94	0.387	3.46	0.544	1
19, 20, and 21	7,776	10,700,000	52.6	0.387	20.4	0.544	1
37e, f, g, j, k	8,400	40,357,000	485	0.193	93.4	0.335	1
38a	4,056	5,250,000	90.9	0.193	17.5	0.335	1
37e, f, g, j, k, and 38a	8,400	45,607,000	576	0.193	111	0.335	1
42	8,760	3,513,600	143	0.182	26.1	0.323	1
43	1,946	885,600	35.9	0.194	6.98	0.336	1
44	2,496	695,700	34.1	0.255	8.70	0.402	1
42, 43, and 44	8,760	5,095,000	213	0.196	41.8	0.338	1
7	904	11,600	1.23	0.17	0.209	0.31	3
23	1,170	47,000	1.81	0.17	0.308	0.31	3
29	840	5,625	0.349	0.8	0.279	0.99	1
30	96	1,028	0.192	0.8	0.154	0.99	1
31	192	2,056	0.385	0.8	0.308	0.99	1

model HW, were based on the average values of these parameters from the streams that they represent.

The wastewater flow rates for models LFr and HFr were estimated using values that resulted in approximately the same nationwide control cost as the sum of the costs to control wastewater streams from the individual processes. Algorithms used to estimate costs are described in the cost impacts memorandum.[7] As shown in Table 8, wastewater flow rates varied over a wide range. Because the relationship between flow rate and total annual cost is not linear, using arithmetic mean flowrates in the models resulted in overstated nationwide costs, and median flowrates resulted in understated costs. Therefore, values between the arithmetic mean and median values were selected. The HAP concentrations were calculated based on the load and flowrate for the model.

VI. Bag Dumps and Product Dryers

Only two surveyed facilities had particulate (PM) HAP emissions from bag dumps and product dryers; both were controlled to the level of the MACT floor.[4] Any other facilities in the industry that have PM HAP emissions from bag dumps and product dryers were assumed to be controlled to the same level. Therefore, no model bag dumps or product dryers were developed.

VII. Model Plants for Existing Sources

This section describes the procedure that was used to develop four model plants. The model plants consist of various combinations of the model process vents, equipment components, storage tanks, and wastewater systems that were developed in sections II through V. The components of each model plant are shown in Table 12.

The procedure used to develop the model plants consisted of three basic steps. First, each of the actual emission points at the 20 surveyed plants was represented with a model emission point, and the plants were categorized into groups with similar characterisitics. Second, the distribution of model processes at the 58 modelled plants was estimated. Third, model emission points were assigned to each of the model plants to achieve two

TABLE 12. MODEL PLANT CHARACTERISTICS

Model emission points	No. of model emission points per model plant				
	A	B	C	D	Total[a]
No. of model plants nationwide	26	12	15	5	58
Process vents					
Model No. 1	1	0	1	1	46
Model No. 2	0	1	0	2	22
Model No. 3	0	0	1	0	15
Model No. 4	0	0	0	2	10
Equipment leaks					
Model batch process	1	2	2	3	95
Model continuous process	0	0	1	2	25
Storage tanks					
Model 1B	1	0	0	0	26
Model 2B	0	0	0	1	5
Model 3B	0	0	1	0	15
Wastewater streams					
Model LFr	0	0	0	1	5
Model HFr	0	1	0	0	12
Model HW	0	0	1	0	15

[a]Totals for the model emission points are calculated using the total number of model plants multiplied by the number of model emission points.

objectives: (1) that the characteristics of the model plants be as consistent as possible with the average characteristics of the groups of surveyed plants and (2) that the nationwide population and distribution of emission points using the model plants be similar to the nationwide population and distribution of the individual model emission points developed in sections II through V of this memorandum. These steps are described in more detail below.

The first step in developing the model plants was to assign model processes, equipment component counts, storage tanks, and wastewater systems to each of the actual corresponding types of emission points at the 20 surveyed plants. Each of the model emission points characterize emission points that would be needed to implement controls to meet the proposed standards.[4] Model processes were assigned to each surveyed process with uncontrolled organic HAP emissions ≥0.15 Mg/yr (≥330 lb/yr) and/or HCl emissions ≥6.8 Mg/yr (7.5 tons/yr); all surveyed processes were included because all processes at the modelled plants were assumed to have organic HAP controls below the level of the standard. Model equipment component counts were assigned to each of the 88 surveyed processes that had organic HAP emissions, regardless of the level. Model storage tanks were assigned to represent storage tanks that would need to add controls to meet the MACT floor; thus, only three of the nine model tanks were needed. Model wastewater streams were assigned to represent each wastewater stream that meets the concentration and load criteria described in section V.B. The plants were then categorized into four groups with similar characteristics. These four groups are shown in Table 13.

The second step was to determine the number of processes at each of the 58 modelled plants. As noted in Section II, the 58 modelled plants were assumed to have an average of two processes per plant, for a total of 116 processes. To approximate two processes per plant, 52 percent of the 58 plants were assumed to have one process (30 plants), 31 percent have two processes (18 plants), and 17 percent have 5 processes (10 plants). This

TABLE 13. BASIS FOR MODEL PLANTS

Group	Surveyed plants	No. of actual processes with uncontrolled organic HAP emissions >0.15 Mg/yr and/or HCl emissions >6.8 Mg/yr represented by each model process					Total No. of processes for equipment leaks[a]	No. of storage tanks subject to control represented by each model tank[b]				No. of processes with wastewater streams subject to control and represented by each model wastewater stream[c]		
		1	2	3	4	Total		1B	2B	3B	Total	1	2	Total
I	6	1	0	0	0	1	1	0	0	0	0	0	0	0
	16	x[d]	x	x	x	1	0	0	0	0	0	0	0	0
	19	1	0	0	0	1	1	0	0	0	0	0	0	0
II	10	0	0	0	1	1	2	0	0	0	0	0	0	0
	13	x	0	x	0	1	2	1	0	0	1	1	0	1
	20	1	0	0	0	1	2	2	0	0	2	0	0	0
III	5	0	1	1	0	2	2	0	0	0	0	0	0	0
	7	1	0	1	0	2	2	0	0	0	0	0	0	0
	9	0	1	0	1	2	1	0	0	0	0	0	0	0
	15	3	0	0	0	3	10	0	0	0	0	0	4	4
IV	1	0	0	4	0	4	4	0	0	0	0	0	0	0
	3	2	1	0	1	4	9	0	0	0	0	1	0	1
	8	1	1	0	2	4	3	0	0	1	1	0	0	0
	11	1	x	x	1	9	9	2	0	1	3	4	5	9
	12	1	2	0	1	4	4	0	2	0	2	1	0	1
	14	5	0	0	0	5	5	0	0	0	0	0	1	1
	17	0	1	3	0	4	4	0	0	0	0	0	0	0
	21	6	1	0	0	7	7	2	0	0	2	2	0	2
	22	6	5	1	1	13	12	0	0	0	0	3	0	3
	23	3	2	0	1	6	8	0	0	2	2	0	0	0

[a]At some plants, the number of processes for equipment leak emissions is less than the number of processes for process vent emissions because one or more processes has only HCl emissions.
[b]Storage tanks subject to control have uncontrolled emissions ≥250 lb/yr and existing control levels <95 percent. Of the nine model tanks, only models 1B, 2B, and 3B represent tanks at the surveyed plants that meet the criteria for control.
[c]Wastewater streams subject to control meet the concentration and load criteria specified in Section V.
[d]An "x" denote uncertainty about which model characterizes the given process.

distribution is similar to the distribution in the 1986 OW survey.[3] Data from the surveyed plants were extrapolated to estimate that only 93 of the 116 processes have uncontrolled organic HAP emissions ≥0.15 Mg/yr (≥330 lb/yr) and/or uncontrolled HCl emissions ≥6.8 Mg/yr (7.5 tons/yr). The estimated distribution of these 93 processes at the 58 plants is shown in Table 14. The 38 plants with 1 process were split between model plants A and B in Table 11 in such a way as to achieve approximately the same number of model processes no. 1 and no. 2 as in Table 3.

Although there are similarities among plants in each of the groups in Table 13, there are also many differences. Model plants based simply on the most prevalent characteristics in each group would have a distribution of emission points that is inconsistent with the distribution developed in sections II through V of this memorandum. Therefore, the third step was to assign model emission points in such a way that the two approaches result in approximately the same total number and distribution of emission points. The number of model processes assigned to model plants A, B, and C was based on the average number of processes at the surveyed plants in groups I, II, and III; model plant D was assigned five processes instead of the average of six at the surveyed plants in group IV because (1) the analysis above estimated five processes for the largest model plant and (2) five is the median number of processes at the surveyed plants in group IV. Distributing model processes among the model plants in the same ratio as at the surveyed plants did not result in the correct nationwide distribution of model processes; therefore, assignments were adjusted as necessary to achieve the correct nationwide distribution. Model processes for equipment leak emissions correlated with the model processes at a model plant, except that an extra batch process was added to model plants B and C to account for processes with process vent emissions below the 0.15 Mg/yr threshold.

At the surveyed plants, storage tanks were concentrated at plants in group IV. If the same distibution were used at model

TABLE 14. DISTRIBUTION OF PROCESSES AT MODEL PLANTS

No. of processes per plant	No. of model plants nationwide	Total No. of processes nationwide	Nationwide No. of plants with processes that emit organic HAP ≥0.15 Mg/yr			Nationwide No. of processes that emit organic HAP ≥0.15 Mg/yr
			1 process per plant	2 processes per plant	5 processes per plant	
1	30	30	30	0	0	30
2	18	36	8	10	0	28
5	10	50	0	5	5	35
Total	58	116	38	15	5	93

plants, the nationwide number of tanks would be under represented. Therefore, one model tank was also assigned to model plants A and C.

At the surveyed plants, most of the wastewater streams (17 out of 22) were at plants in group IV; the others were at plants in groups and III. Assigning most of the model streams to model plant D would under represent the number of wastewater streams. Therefore, model plant B was assigned a model wastewater stream. These model wastewater stream assignments result in approximately the correct total number of wastewater streams, but the distribution is biased towards model stream 3.

Table 15 compares the nationwide number of model emission points developed by the two approaches. Because there are differences, the nationwide cost and environmental impacts also would be different for the model plants than for the sum of the individual model emission points. However, the model plants should characterize the range of plants in the industry, especially those with few processes.

VIII. Model Plants for New Sources

The four model plants used to characterize existing sources were also used to characterize new sources, but the nationwide allocation of each model is lower for new sources. Average annual growth rates in PAI sales in the five years after the standards are promulgated were estimated to be about 2 percent. This rate translates into a total of 8 new facilities that would be subject to the standards $(78*(1.02^5-1)=8)$.[8] It was assumed that the plant size distribution for new sources would be the same as for existing sources. Thus, the model plants were allocated as follows: three of model plant A, two of model plant B, two of model plant C, and one of model plant D.

TABLE 15. COMPARISON OF TOTAL MODEL EMISSION POINTS BY TWO APPROACHES

Model emission point	No. of model emission points	
	Individual emission point basis	Model plant basis
Process vents		
Model No. 1	48	46
Model No. 2	19	22
Model No. 3	14	15
Model No. 4	12	10
Equipment leaks		
Model batch process	90	95
Model continuous process	26	25
Storage tanks		
Model 1B	26	26
Model 2B	6	5
Model 3B	12	15
Wastewater systems		
Model LFr	10	5
Model HFr	11	12
Model HW	9	15

IX. References

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MRI

MIDWEST RESEARCH INSTITUTE
Suite 350
401 Harrison Oaks Boulevard
Cary, North Carolina 27513-2412
Telephone (919) 677-0249
FAX (919) 677-0065

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EPA Contract No. 68D60012; Task Order No. 0004
ESD Project No. 93/59; MRI Project No. 4800-04

From: David Randall
Karen Schmidtke
Charlie Hale

To: Lalit Banker
ESD/OCG (MD-13)
U. S. Environmental Protection Agency
Research Triangle Park, NC 27711

I. Introduction

The purpose of this memorandum is to present the estimated baseline HAP emissions for the pesticide active ingredient (PAI) production industry. The emissions were calculated for five types of emission points: process vents, equipment leaks, storage tanks, wastewater systems, and bag dumps and product dryers. The emissions are for an estimated 78 sources nationwide.

For each type of emission point, site-specific emissions are presented for 20 plants that responded to EPA information requests (i.e., "surveyed" plants). Also presented are nationwide emissions for models that represent the emission sources at the other 58 plants.

Table 1 shows the estimated total baseline emissions are about 6,750 Megagrams per year (Mg/yr) (7,450 tons per year [tons/yr]). Baseline emissions from equipment leaks account for approximately half of the total. Combined, emissions from process vents and wastewater systems account for the other half. Emissions from storage tanks and bag dumps and product dryers account for less than 1 percent of the total baseline emissions from PAI production plants.

TABLE 1. BASELINE HAP EMISSIONS IN THE PAI MANUFACTURING INDUSTRY

Emission source	Baseline HAP emissions	
	Mg/yr	Percent of total
Process vents	1,770	26
Equipment leaks	3,410	50
Storage vessels	37.3	0.6
Wastewater systems	1,530	23
Bag dumps and product dryers	8.5	0.1
Total	6,750	100

The remainder of this memorandum is divided into six sections. Sections II through VI provide additional details about the emissions from each of the five types of emission points. The procedures used to estimate the emissions are also presented in Sections II through VI. Section VII lists the references.

II. <u>Process Vents</u>

Table 2 shows the uncontrolled and baseline emissions from process vents at PAI production plants. For the surveyed plants, the emissions are based on the actual emissions that were reported for all of the processes at each plant.[1]

For the modelled plants, the uncontrolled emissions per model process and the estimated population of each of the four model processes are presented in the model plants memorandum.[2] The product of these values yields the nationwide uncontrolled emissions per model process that are shown in Table 2. The control efficiency for organic HAP for the model processes was estimated to be 80 percent; this control efficiency is equal to the arithmetic mean control efficiency for 72 processes with organic HAP emissions of 0.15 Mg/yr (0.17 ton/yr) or greater at the surveyed plants (i.e., processes that were used as the basis for the model processes).[2]

A similar method was used to estimate the combined HCl and chlorine (HCl) control efficiencies for the model processes. Sixteen of the surveyed processes had HCl emissions equal to or greater than the MACT floor applicability cutoff of 6.8 Mg/yr (7.5 ton/yr).[1,3] The average control efficiency for these processes was over 93 percent; this value is close to the MACT floor control level of 94 percent.[3] Therefore, the 16 processes were divided into two groups. Eleven processes with HCl control

TABLE 2. BASELINE HAP EMISSIONS FOR PROCESS VENTS

Plant	Uncontrolled emissions, Mg/yr			Control efficiency, percent		Baseline emissions, Mg/yr		
	Organic	HCl	Other	Organic	HCl	Organic	HCl	Other
1	171	0.790	0	41.5	50.0	99.9	0.400	0
3	52.9	9.00	0	94.7	99.0	2.87	0.090	0
5	52.8	0	0	1.68	N/A	51.9	0	0
6	16.5	0	0	90.0	N/A	1.65	0	0
7	45.8	0	0	70.6	N/A	13.5	0	0
8	219	34.5	0	93.3	91.1	14.6	3.21	0
9	18.2	530	0	98.0	99.9	0.360	0.53	0
10	31.3	0	1.39	26.4	N/A	23.0	0	0.274
11	392	2.06	0	75.7	99.0	95.1	0.020	0
12	276	105	7.71	96.6	98.8	9.63	1.21	0.0086
13	18.9	0	0	96.5	N/A	0.670	0	0
14	9.96	0	0	98.0	N/A	0.20	0	0
15	2.71	0.160	0	1.0	0	2.68	0.160	0
16	0	0	0	N/A	N/A	0	0	0
17	224	0	0	96.3	N/A	8.30	0	0
19	34.3	0	0	99.5	N/A	0.17	0	0
20	82.0	0	0.090	99.0	N/A	0.950	0	0.090
21	166	12.0	0	58.4	80.4	69.0	2.36	0
22	2,420	3,300	0	98.0	91.1	48.6	294	0.300
23	130	152	0	76.8	98.9	30.2	1.58	0
Model process 1	658	0	0	80	N/A	131	0	0
Model process 2	760	1,260	0	80	a	152	88	0
Model process 3	574	0	0	80	N/A	115	0	0
Model process 4	1,220	3,540	0	80	b	244	260	0
Total	7,580	8,940	9.19			1,120	650	0.37

[a]Of the 19 model 2 processes, 13 (69 percent) model processes are controlled to 99 percent and 6 (31 percent) are controlled to 80 percent.
[b]Of the 12 model 4 processes, 8 (69 percent) are controlled to 99 percent and 4 (31 percent) are controlled to 80 percent.

efficiencies over 94 percent were in one group, and five processes with HCl control efficiencies below 94 percent were in the second group. The average HCl control efficiencies for the two groups were 99 and 80 percent, respectively. Therefore, for the models with HCl emissions (models 2 and 4), approximately 69 percent are controlled to 99 percent, and 31 percent are controlled to 80 percent.

III. Equipment Leaks

Table 3 shows the uncontrolled and baseline emissions from equipment leaks at PAI production plants. For the surveyed plants, uncontrolled emissions for equipment leaks were calculated by two procedures. The first procedure was used for the 30 processes for which equipment count data were available. Emissions from most of these processes were calculated using actual equipment counts and actual operating hours. When actual operating hours were not available for a process, the emissions were estimated using average operating hours (i.e., the hours from the equipment leak models).[2] In all but one case, the uncontrolled emissions were based on average SOCMI emission factors.[4] Light liquid factors were used for liquid valves and pumps because each process with organic HAP in the process fluid had at least one compound that would satisfy the vapor pressure condition for light liquid service.[5] Two processes with only inorganic HAP in the process fluid were assumed to have no equipment leak emissions. The exception to the use of SOCMI average emission factors was for one plant that provided initial leak rates for some components, which could be used in the average leak rate equations.[6] Detailed calculations for each process are provided in the attachment to this memorandum. The second procedure was based on the use of model equipment counts and operating hours and average SOCMI emission factors. The model plant memorandum presents the component counts for the batch and continuous models; it also gives the number of processes that were represented with each model.[2]

Baseline emissions for six of the surveyed plants were estimated based on information about leak detection and repair (LDAR) programs that were implemented for some or all of their processes. The methodology used to estimate the baseline emissions varied depending on the specifics of the LDAR program in use. When the plant implemented an LDAR program with requirements at least as stringent as those under phase III in 40 CFR part 63 subpart H, the control effectiveness was estimated to be 92 percent for gas valves, 88 percent for light liquid valves, 75 percent for pumps, and 93 percent for connectors.[5,7] When the leak definition and monitoring frequency of the LDAR program corresponded with guidance in the CTG on equipment leaks for SOCMI and polymer production equipment, the control effectiveness was estimated to be 64 percent for gas valves, 44 percent for light liquid valves, 33 percent for light liquid pumps, and no control for connectors.[8] Baseline emissions for

TABLE 3. BASELINE HAP EMISSIONS FOR EQUIPMENT LEAKS

Plant	Uncontrolled emissions, Mg/yr	Control efficiency, %	Baseline emissions, Mg/yr
Surveyed plants			
1	56.8	30.5	39.5
3	137	0	137
5	48.1	0.7	47.8
6	0.56	0	0.56
7	57.7	0	57.7
8	69.0	0	69.0
9	14.2	24.6	10.7
10	90.6	76.1	21.6
11	242	0	242
12	80.4	0	80.4
13	22.7	0	22.7
14	56.7	0	56.7
15	107	76.5	25.1
16	0[a]	N/A	0[a]
17	128	90.2	12.6
19	11.3	0	11.3
20	22.7	0	22.7
21	79.4	0	79.4
22	136	0	136
23	126	0	126
Models			
Model 1	1,020	0	1,020
Model 2	1,200	0	1,200
Total	3,700		3,410

[a]The only HAP used at this plant is a granular organic raw material.

the other 14 surveyed plants were assumed to be the same as the uncontrolled emissions. Detailed calculations for each process at these six plants are provided in the attachment to this memorandum.

The uncontrolled equipment leak emissions from the 116 processes at the 58 model facilities were estimated using the equipment leak models and the estimated population of these models that are presented in the model plant memorandum.[2] The product of these values gives the nationwide uncontrolled emissions per model, as shown in Table 3. The control efficiency for the models was assumed to be 0 percent for two reasons. First, the average control efficiency of the five surveyed plants that were not used in the MACT floor determination was only 7 percent. This efficiency is much lower than would be expected with any existing control programs such as those in the 1984 CTG, Subpart VV, or the HON.[7-9] Second, many of the surveyed plants were selected on the basis that they were likely to be better controlled than the rest of the industry; thus, even 7 percent may be high. Therefore, baseline emissions were estimated to be equal to the uncontrolled emissions.

IV. Storage Tanks

Three approaches were evaluated for determining the baseline HAP emissions from storage tanks in the PAI production industry. Each approach uses the actual emissions for the storage tanks at the surveyed plants and estimated emissions for model storage tanks at the modelled plants. The estimates differ under the three approaches because different methodologies were used to estimate current control efficiencies for the model storage tanks. The methodologies for the three approaches are as follows:

1. Assume the control efficiency for modelled tanks is 0 percent;
2. Assume the average control efficiency for tanks at surveyed plants is representative of the efficiency for modelled storage tanks; or
3. Assume the average control efficiency for surveyed storage tanks not at the top 12 percent facilities, i.e., the average efficiency at non-MACT floor plants, is the control efficiency at each of the modelled tanks.

The number of storage tanks and their uncontrolled emissions and other characteristics were developed in separate analyses. The surveyed plants reported a total of 82 storage tanks that contain organic HAP.[1] Nine model storage tanks were developed to represent an estimated total of 238 storage tanks at the modelled plants.[2]

Approach 1 would overestimate the baseline emissions because it is unlikely that the 11 surveyed plants with storage tank controls are the only plants in the industry that control storage tank emissions. If all of the modelled storage tanks were assumed to be uncontrolled, the baseline emissions would be 172 Mg/yr (190 ton/yr).

The second approach would provide an average control efficiency for each of the nine model storage tanks and a lower estimate of baseline emissions than Approach 1. Under this approach, control efficiencies for B and C models range from 0 percent to 50 percent. The average control efficiency for A models was estimated to be 95 percent.[2] The baseline emissions would be 37.3 Mg/yr (41.1 ton/yr) with this approach.

Approach 3 was developed because it was expected that the control efficiencies might be lower at the non-MACT floor plants. However, the average control efficiencies for the 40 tanks at the non-MACT floor plants and the 42 tanks at the MACT floor plants are actually similar. The control efficiencies are similar because storage tank emissions make up such a small portion of a plant's overall emissions that they do not affect a plant's overall HAP control efficiency or its overall ranking in the MACT floor analysis. As a result, the baseline emissions for Approaches 2 and 3 are similar. The baseline emissions for Approach 3 would be 36.5 Mg/yr (40.2 ton/yr).

Approach 2 is believed to be the simplest, most reasonable approach and was used to estimate the baseline emissions from the modelled storage tanks. Table 4 provides the baseline emissions from the 82 surveyed storage tanks and the 238 modelled storage tanks. The baseline emissions level for tanks is 37.3 Mg/yr (41.1 ton/yr). These emissions are approximately two orders of magnitude lower than the emissions from process vents, equipment leaks, and wastewater systems.

V. Wastewater Systems

Table 5 shows the uncontrolled and baseline emissions from wastewater systems at surveyed and modelled PAI production plants. Uncontrolled emissions for the surveyed plants were based on the fraction of the reported loading with a potential to volatilize from the water. The reported loadings and calculated uncontrolled emissions were presented in the data summary memorandum.[1] Baseline emissions for 15 of the surveyed plants were assumed to be the same as the uncontrolled emissions because only biotreatment or no treatment was received before discharge (one of the 15 plants did not provide loading data). Three of the surveyed plants used incineration or either steam or air stripping followed by incineration to treat some or all of the wastewater. The methodology used to calculate the controlled emissions for wastewater streams at these three plants was also described in the data summary memorandum.[1] Wastewater streams at two of the surveyed plants contained no HAP.

TABLE 4. BASELINE HAP EMISSIONS FOR STORAGE VESSELS

Model	Number of tanks	Total uncontrolled emissions, Mg/yr	Control efficiency, percent	Baseline emissions, Mg/yr	Model	Total uncontrolled emissions, Mg/yr	Control efficiency, percent	Baseline emissions, Mg/yr
Surveyed plants					Modeled plants			
Basis of Model 1-A (9 tanks)	9	5.76	98	0.115	Model 1-A (26 tanks)	16.6	95	0.832
Basis of Model 1-B (9 tanks)	5	1.24	0.0	1.24	Model 1-B (26 tanks)	6.93	11	6.17
	1	0.553	4.0	0.531				
	1	0.231	13.2	0.201				
	1	0.118	41	0.0694				
	1	0.260	42	0.151				
Basis of Model 1-C (23 tanks)	12	0.204	0.0	0.204	Model 1-C (67 tanks)	2.08	45	1.14
	1	0.0456	89	0.0050				
	3	0.121	90	0.0121				
	1	0.0451	95	0.0023				
	5	0.241	98	0.0048				
	1	0.0555	99.5	0.0003				
Basis of Model 2-A (8 tanks)	8	3.34	98	0.0669	Model 2-A (23 tanks)	9.62	95	0.481
Basis of Model 2-B (2 tanks)	2	1.10	0.0	1.10	Model 2-B (6 tanks)	3.30	0.0	3.30
Basis of Model 2-C (11 tanks)	9	0.134	0.0	0.134	Model 2-C (32 tanks)	0.540	18	0.442
	2	0.0512	98	0.0010				
Basis of Model 3-A (12 tanks)	4	33.1	95	1.65	Model 3-A (34 tanks)	112	95	5.60
	8	6.49	98	0.130				
Basis of Model 3-B (4 tanks)	3	2.43	0.0	2.43	Model 3-B (12 tanks)	10.5	6.0	9.88
	1	1.08	25	0.809				
Basis of Model 3-C (4 tanks)	2	0.165	0.0	0.165	Model 3-C (12 tanks)	0.869	50	0.435
	2	0.125	98	0.0025				
Total		56.9		9.02		163		28.3

TABLE 5. BASELINE HAP EMISSIONS FOR WASTEWATER SYSTEMS

Plant	Uncontrolled emissions, Mg/yr	Control efficiency, %	Baseline emissions, Mg/yr
1	6.17	0	6.17
3	1.84	0	1.84
5	2.17	0	2.17
6	0	N/A	0
7	0.835	0	0.835
8	42.5	a	0
9	b	c	b
10	0.173	93.2	0.0117
11	931	99	9.31
12	1.26	0	1.26
13	25.1	1.9	24.7
14	10.9	0	10.9
15	9.35	0	9.35
16	0	N/A	0
17	29.4	0	29.4
19	11.6	0	11.6
20	0.0147	a	0
21	112	0	112
22	43.1	0	43.1
23	c	0	c
Model wastewater streams	1,260	0	1,260
Total	2,490		1,530

[a]Deep-well injection, 100 percent control efficiency.
[b]Less than 5 ppmw.
[c]No data provided.

The uncontrolled emissions per model wastewater stream and the estimated population of each model stream are presented in the model plant memorandum.[2] These data were used to estimate nationwide uncontrolled emissions of 1,260 Mg/yr (1,390 ton/yr) for the modelled portion of the industry, as shown in Table 5. The control efficiency of treatment systems for the model streams was assumed to be zero percent. This value was selected because the control efficiency was zero for most of the surveyed facilities, including 8 of the 11 plants that were not used in the MACT floor analysis (of the other three, one had a control efficiency of 93 percent, one had a control efficiency of 2 percent, and one had no HAP in its wastewater). Thus, baseline emissions for wastewater streams at the model plants were estimated to be equal to the uncontrolled emissions.

Table 6 presents the nationwide emissions for all 45 processes with wastewater streams at both the surveyed and model plants. The model plant memorandum describes the basis for uncontrolled emissions and the population of each model stream.[2] Streams for which the baseline emissions are lower than the uncontrolled emissions represent the controlled streams at surveyed plants 10, 11, and 13.

VI. Bag Dumps and Product Dryers

Two of the surveyed plants emitted particulate matter HAP; one facility emitted from a product dryer, and the other emitted from a raw material bag dump.[1] The total emissions from these two plants was 8.5 Mg/yr (9.3 tons/yr). Because they were uncommon at the surveyed plants, no bag dumps or product dryers were included in the model plants analysis.[2] Therefore, the nationwide baseline emissions from bag dumps and products dryers was estimated to be equivalent to the emissions from the surveyed plants.

TABLE 6. BASELINE EMISSIONS FOR MODEL WASTEWATER STREAMS

Wastewater stream model number	Number of wastewater streams			Uncontrolled emissions, Mg/yr			Baseline emissions, Mg/yr		
	Surveyed plants	Modelled plants	Total	Surveyed plants	Modelled plants	Total	Surveyed plants	Modelled plants	Total
12	1	1	2	0.00319	0.00319	0.00639	0.00319	0.00319	0.00639
39	1	1	2	0.0254	0.0254	0.0509	0.0254	0.0254	0.0509
36	1	1	2	0.0147	0.0147	0.0294	0	0.0147	0.0147
28	1	1	2	0.0406	0.0406	0.0813	0.0406	0.0406	0.0813
6	1	1	2	0.0294	0.0294	0.0588	0.0294	0.0294	0.0588
11	1	1	2	0.169	0.169	0.338	0.00846	0.169	0.178
30	1	1	2	0.154	0.154	0.308	0.154	0.154	0.308
4	1	1	2	0.185	0.185	0.370	0.185	0.185	0.370
29	1	1	2	0.279	0.279	0.559	0.279	0.279	0.559
31	1	1	2	0.308	0.308	0.615	0.308	0.308	0.615
3	1	1	2	0.308	0.308	0.617	0.308	0.308	0.617
45	1	1	2	0.316	0.316	0.631	0.316	0.316	0.631
33	1	1	2	0.330	0.330	0.661	0.330	0.330	0.661
24	1	1	2	0.319	0.319	0.639	0.319	0.319	0.639
41	1	1	2	0.502	0.502	1.00	0.502	0.502	1.00
40	1	1	2	0.527	0.527	1.05	0.527	0.527	1.05
22	1	1	2	0.637	0.637	1.27	0.637	0.637	1.27
9	1	2	3	0.835	1.67	2.50	0.835	1.67	2.50
2	1	2	3	0.740	1.48	2.22	0.740	1.48	2.22
7	1	2	3	0.209	0.418	0.627	0.209	0.418	0.627
23	1	2	3	0.308	0.617	0.925	0.308	0.617	0.925
5	1	2	3	1.61	3.21	4.82	1.61	3.21	4.82
25	1	2	3	0.540	1.08	1.62	0.0540	1.08	1.13
1	1	2	3	4.94	9.87	14.8	4.94	9.87	14.8
8	1	2	3	2.17	4.34	6.51	2.17	4.34	6.51
20	1	2	3	3.46	6.93	10.4	0.0346	6.93	6.96
32	1	2	3	8.57	17.1	25.7	8.57	17.1	25.7
27	1	2	3	10.9	21.8	32.7	10.9	21.8	32.7

TABLE 6. BASELINE EMISSIONS FOR MODEL WASTEWATER STREAMS (CONTINUED)

Wastewater stream model number	Number of wastewater streams			Uncontrolled emissions, Mg/yr			Baseline emissions, Mg/yr		
	Surveyed plants	Modelled plants	Total	Surveyed plants	Modelled plants	Total	Surveyed plants	Modelled plants	Total
19	1	1	2	7.95	7.95	15.9	0.0795	7.95	8.03
13	1	1	2	12.4	12.4	24.9	0.124	12.4	12.6
21	1	1	2	8.97	8.97	17.9	0.0897	8.97	9.05
44	1	1	2	8.70	8.70	17.4	8.70	8.70	17.4
35	1	1	2	11.6	11.6	23.2	11.6	11.6	23.2
43	1	1	2	6.98	6.98	14.0	6.98	6.98	14.0
26	1	1	2	24.6	24.6	49.2	24.6	24.6	49.2
15	1	1	2	37.3	37.3	74.7	0.373	37.3	37.7
34	1	1	2	29.1	29.1	58.2	29.1	29.1	58.2
14	1	1	2	46.0	46.0	91.9	0.460	46.0	46.4
38	1	1	2	17.7	17.7	35.4	17.7	17.7	35.4
42	1	1	2	26.1	26.1	52.2	26.1	26.1	52.2
10	1	1	2	42.5	42.5	84.9	0	42.5	42.5
18	1	1	2	181	181	361	1.81	181	182
17	1	1	2	308	308	615	3.08	308	311
37	1	1	2	94.7	94.7	189	94.6	94.7	189
16	1	1	2	327	327	653	3.27	327	330
Total						2,490			1,530

VII. References

1. Memorandum from D. Randall and K. Schmidtke, MRI, to L. Banker, EPA:ESD. April 15, 1996. Summary of Data From Responses to Information Requests and Site Visits for the Production of PAI NESHAP.

2. Memorandum from D. Randall and K. Schmidtke, MRI, to L. Banker, EPA:ESD. April 30, 1997. Model Plants for the PAI Production Industry.

3. Memorandum from D. Randall and K. Schmidtke, MRI, to L. Banker, EPA:ESD. April 30, 1997. MACT Floor and Regulatory Alternatives for the Pesticide Active Ingredient Production Industry.

4. Protocol for Equipment Leak Emission Estimates. Office of Air Quality Planning and Standards. U. S. Environmental Protection Agency. EPA-453/R-95-017. November 1995. p. 2-12.

5. 40 CFR Part 63, Subpart H, section 163.161.

6. Reference 4. p. 5-46.

7. Reference 4. p. 5-9.

8. Control of VOC Fugitive Emissions from Synthetic Organic Chemical, Polymer, and Resin Manufacturing Equipment. EPA-450/3-83-006. Office of Air Quality Planning and Standards. U. S. Environmental Protection Agency. Research Triangle Park, NC. March 1984.

9. 40 CFR Part 60. Subpart VV.

Attachment

Docket No. A-95-20

Category II-B

The following information is located in the confidential files of the Director, Emission Standards Division, Office of Air Quality Planning and Standards, U. S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711. This information is confidential pending final determination by the Administrator and is not available for public inspection.

Attachment to Baseline Emissions Memorandum (part of docket item II-B-21).

This attachment consists of calculated uncontrolled and controlled equipment leak emissions for 30 processes at 8 plants. The confidential material consists of 17 pages of data.